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Development of Improved Highways

By THOMAS H. MACDONALD, Chief of Bureau, and H. S. FAIRBANKS, Highway Engineer,
U. S. Bureau of Public Roads, Washington, D. C.

(A paper read before the Western Society of Engineers, April 21, 1926.)

Of the 3,002,916 miles of highways of all classes in the United States, approximately 448,000 miles were improved with some form of surfacing at the close of the year 1924, according to the best available estimates. If the last year's work has been as productive as that of 1924—and there is every reason to believe that it has been—the surfaced roads at present aggregate not far from 500,000 miles, about one-sixth of the total mileage.

Accepting the latter figure as reasonably representative of the present condition, it will be convenient hereafter to deal with the more exact figures of 1924, especially since surveys made by the Office of Public Roads in 1904 and 1914 furnish the statistical basis for the determination of the character and extent of the progress made during the last two decades.

According to these surveys there were 257,291 miles of surfaced roads in 1914, and 153,662 miles in 1904. The net increase during the first of the two decades was, therefore, a little over 100,000 miles, or approximately 10,000 miles a year; and this rate was more than doubled during the second and last decade.

The relative progress made during these two ten-year periods, however, is not expressed fully by the net increase in surfaced mileage. It is safe to say that practically all of the roads that were surfaced in 1904 have since been resurfaced and undoubtedly a considerable percentage of the 257,291 miles surfaced in 1914 has also been replaced with new, better and wider surfaces since that date. The real measure of progress made during the last decade is, therefore, not the net increase of more than 211,000 miles, but a figure which much more nearly approaches the total of improved mileage at the close of the period.

Rapid Progress in Last Decade

The true extent of the change becomes apparent when we examine the character of the roads classified as surfaced at the three survey periods. Of the 153,662 miles surfaced in 1904 only 141 miles, or less than one-tenth of 1 per cent of the total, were improved with a surface better than waterbound macadam. By 1914 the mileage of this class of roads had increased to 14,830, or 5.8 per cent of the total mileage then surfaced; but more than two-thirds of the roads so classed were surfaced with bituminous macadam and surface-treated water-bound macadam, the least durable of the types included in the class. The increase in the mileage of high types to a total of 89,771 miles between 1914 and 1924 is, therefore, more remarkable in view of the fact that the surface-treated and bituminous macadam roads constituted in the latter year less than half of the total mileage of the class, which as a whole represented more than 19 per cent of the total surfaced mileage. More than 45,000 miles in 1924 were paved with concrete, brick, bituminous concrete or equivalent types; and the average width and strength of all surfaces included in the high-type class were doubtless considerably greater than in the earlier years.

In 1904 there were 38,622 miles of water-bound macadam roads—practically 25 per cent of the total surfaced mileage. By 1914 the mileage of this type had increased to 64,898, but the percentage of the total mileage remained practically unchanged at 25 per cent; and in the last decade both the mileage and the percentage diminished, the former to 60,235 miles and the latter to 12.9 per cent, a relative decrease of nearly 50 per cent.

In all three years the roads surfaced with gravel and other low types of surfaces constituted the bulk of the surfaced mileage, but whereas in 1904 they constituted practically three-quarters of the total, in 1924 they represented only a little more than two-thirds. The mileage

of these types in 1904 was 114,899; in 1914 it was 177,563; and in 1924 there were 317,960 miles.

These changes in the character of the surface mileage during the two decades are shown more clearly in the table given at the bottom of this page.

Low-Type Roads Served Early Traffic

The year 1904 marks the end of a period. Up to that time there had been no important change in the methods of road construction which had been employed for a century or more. The major types of surfacing were gravel and macadam, and either was known to give entire satisfaction under the traffic normal to the country roads of the time. Other types had been developed and used in small mileage, such as the shell roads of the tidewater States and the sand-clay roads of the South, but the element of availability was the determining factor in the choice of such materials rather than any difference in the demands of traffic; and the same element in fact, largely determined the choice of the two major types.

Thus we find that there was a preponderance of gravel roads in Michigan, Indiana, Illinois, Iowa, Wisconsin, Minnesota and the Dakotas where gravel deposits were plentiful; and a preference for stone in Kentucky, West Virginia and others where suitable gravels were scarce. From New Jersey south, the Atlantic and Gulf States had built rather considerable mileages of oyster-shell roads; and the Southern States, in which there was a scarcity of other materials, had developed the sand-clay type. Even the small mileage of high-type surfaces which had been constructed was doubtless attributable less to traffic demands than to the availability of the materials, for of the total of 141 miles we find that 123 were paved with brick, and 104 were in the two States of Ohio and West Virginia where brick was cheap and perhaps the most available local material.

Viewed broadly the few types of surface constructed up to this time may all be considered as of one class. In the construction of all the same principles governed; in all a fragmental mass was bound together more or less firmly by a natural cement in the manner made familiar by a century of practice, and all alike depended for their efficacy upon the conic principle of pressure transmission by which they spread the vehicular loads and thus reduced the intensity of pressure borne, by the subgrade.

That need was felt for no other kind of construction was due, of course, to the fact that the traffic on all roads was much the same. Even in the most populous States the greater part of the traffic using the roads consisted of relatively light horse-drawn, steel-tired vehicles, to which were added near the cities a bicycle traffic which, though it might attain considerable volume, was never more than a negligible factor in determining the type of surface. This was the normal traffic condition which existed practically up to 1904. What makes that year a turning point in highway history is the fact that about that time there began the great outpouring of motor vehicles from the cities which quickly set the intercity roads apart from others as a class requiring different treatment.

The peculiar effect of the automobile on waterbound macadam roads is so well known as to require no description and the manner in which the road builders met the challenge by substituting tars and asphalts for the weaker mineral binders has been an oft-told tale. First as dust layers then as protective surface coatings, then as binders introduced into roads of the macadam type by penetration, and finally as hot admixtures according to the bituminous concrete principles, these materials, borrowed from the stock in trade of the city street builder solved the automobile problem in a manner which was apparently entirely satisfactory.

The effect of this development in the road-building art is shown by comparison of the statistics of 1904 and 1914, the dates which, to all intents and purposes, mark the beginning and crest of the wave of bituminous construction. In 1904, according to the records, there were in the entire country only 18 miles of bituminous rural roads, all in the two States of Massachusetts and Ohio. By 1914 there were 10,500 miles, a mileage which was nearly three-quarters of the aggregate length of all roads of higher type than macadam. This was the highwater mark of the lower forms of the bituminous types. That it by no means marked the end of their usefulness is indicated by the fact that 3,367 miles of the surface-treated and penetration types were built in 1924. The recession of the tide is indicated, however, by the fact that the mileage of the two types existing in 1924 was less than 50 per cent of the mileage of all types better than water-bound macadam in comparison with the 75 per cent level reachel in 1914.

Heavy Loads Require Rigid Slab

It is generally recognized that these two types which came into use with the development of passenger automobile traffic are especially adapted to that class of traffic. The relative decline in their use began when motor trucks in considerable numbers began to appear on the rural highways; and coincidentally we find an increasing swing toward the rigid pavements of concrete and brick and bituminous concrete on a concrete base. The turning point was reached in 1914 or perhaps a year or two earlier.

The first concrete pavement was built at Bellefontaine, Ohio, in 1893, but up to 1909 no more than five miles

Class of Surface	1904		1914		1924	
	Miles	Percent	Miles	Percent	Miles	Percent
Gravel and other low types	114,899	74.7	177,563	69.1	317,960	67.9
Water-bound macadam	38,622	25.2	64,898	25.1	60,235	12.9
Surfaces better than water-bound macadam	141	0.1	14,830	5.8	89,711	19.2
Total	153,662	100.0	257,291	100.0	467,906	100.0

had been constructed on rural highways in the entire country. In that year approximately four miles were built; in 1910 about twenty miles were added, the following year forty miles, and then the first big increase occurred in 1912 when more than 250 miles of rural highways were paved, to be followed in 1913 with 500 and in 1914 with more than 1,500 miles. At the close of the latter year there were in the entire country 2,348 miles; and ten years later the mileage had increased to 31,146 and construction was proceeding at the rate of more than 6,000 miles a year, a rate approached by no other type better than gravel.

The more extensive use of brick and the bituminous pavements of the mixed type on concrete base began also at about the same time and was due to the same cause—the increased use of motor trucks. In 1914 there were approximately 1,600 miles of brick pavement; in 1924 there were 4,319. In 1914 the mileage of rural highways paved with bituminous concrete or sheet asphalt was still negligible; in 1924 there were more than 9,700 miles of these types.

New Types Developed

The first of the two decades we have had under consideration was marked not only by the development of new types of road, but also by two other changes of even greater significance. The first of these was a general increase in the radius of travel by highway occasioned by the use of the automobile; and the second—a natural result of the first—was a change in the character of the public demand for highway improvement.

In 1904 the automobile had still to prove its ability for sustained performance. Its ownership was still limited to a small and wealthy class. The popular demand for improved roads was, therefore, still predicated upon the use of the bicycle and the horse-drawn vehicle. The farmers, always conservative, were still, for the most part, either actively hostile to road improvement or lukewarm in support of it. In general their demand was for the improvement of the roads connecting their farms with the railroad shipping points or nearby towns. More positive influence was exerted by city and town merchants who sought by road improvement to extend the trading radius and business of their towns and by the limited but influential class of motorists who longed for smoother, mud-and-dust-free roads upon which to operate their vehicles. All these influences combined at first to produce a demand for short stretches of improved roads radiating from the towns and rail shipping points. Later, as the automobile was perfected and its users became more numerous, the latter created a demand for longer, unbroken stretches of improved roads, forming a network connecting the larger towns, a claim that was resisted by the farmers who continued to favor the so-called farm-to-market type of improvement.

State Systems Created

In the smaller Eastern States the conflict never became acute, largely because the distance between towns and market points was so short that the farm-to-market plan of improvement when carried to its ultimate development became practically identical with the inter-town or trunk-line plan. Thus we find the issue satisfactorily settled in Rhode Island as early as 1902 by the adoption of a definite system of State highways for construction by the State Board of Public Roads. A similar proposal by the highway commissioner of Connecticut, made originally in 1906, was enacted into a law by State legislature in 1913; and in the meantime Maryland has settled the question definitely by the adoption of an inter-county seat trunk-line system to be improved and maintained in its entirety with State funds under the State Roads Commission. Maryland's system was designated in 1908 and was the first to be placed completely under State control for both construction and maintenance.

That the controversy was not so quickly settled in many of the other States was due mainly to two reasons. First, the important lines of travel in a number of States were not sharply defined. This resulted in some from sparsity of settlement, and in others from the contrary condition of close settlement, with numerous centers of more or less uniform size and importance. States such as Texas and Wyoming were typical of the first group. In them the long distances between centers and the condition of the roads delayed the development of highway traffic between the towns and promoted a use of the highways largely as feeders to the rail lines; and the same remoteness of the towns one from another prevented the early harmonizing of the two plans of development as in the smaller Eastern States by the evolution of one into the other. Of the second class there were such States as Iowa, Kansas and Wisconsin, in which the very number and uniform size of the town centers caused a diffusion of traffic over many roads and delayed the recognition of routes of outstanding importance. In these States also the towns are essentially agricultural centers and this fact contributed further strength to the demand for farm-to-market roads as opposed to trunk lines.

The instances mentioned furnish examples of one of the reasons for the prolongation of the controversy which raged over the question of farm-to-market vs. trunk-line development. The second reason was simply that many of these States as yet had no State agency for the administration of a highway plan of State-wide scope, and the development of the trunk-line plan naturally presupposes the existence of such an agency.

Federal Aid Developed Trunk Lines

The second of these reasons was promptly removed after the passage of the Federal Aid road act in 1916 by the provision of that act requiring the creation of adequate highway departments in all States as a condition precedent to participation in the benefits of the Federal aid. And a first step toward the ultimate settlement of the trunk-line question in all States was made when the Bureau of Public Roads as one of its first administrative acts requested of all States the submission

of a five-year program map showing the system of roads upon which the State highway departments would request Federal aid during the period covered by the appropriations provided by the first act of Congress. Although the systems designated in response to this request were understood to be merely tentative the request of the Bureau had the effect of directing attention—in many States for the first time—to the desirability of establishing a definite program for the improvement of a system of highways as distinguished from the more or less casual improvement of unrelated sections of roads.

The Federal aid work had scarcely begun, however, when the war intervened and practically put a stop to all operations; and the war did a number of other things to the existing improved roads which, however disastrous they may have appeared at the time, have turned out to be blessings in disguise. At the outset the construction and maintenance of highways were declared to constitute a non-essential industry. As a consequence new construction, except as required for the immediate service of the army, was greatly curtailed. This result is reflected in the records which show in 1916—the year before America's entrance—a construction of the roads under the supervision of the State highway departments amounting to 16,160 miles a decline to 11,996 and 11,944 miles respectively in 1917 and 1918; and a return to 18,260 miles in 1919. Maintenance also was greatly hampered by the difficulty of obtaining the necessary materials and the scarcity and high wages of labor. At the same time there was released upon roads generally inadequate to stand it an unprecedented traffic of heavy motor trucks. To this experience and the heavy damage which followed we owe the development of most of the sound principles and policies which now govern the improvement of highways.

The first result was a strong reaction against the use of heavy motor trucks. There were large numbers of people who, forgetting that a road is of service only in so far as it accommodates the need for economical transportation, demanded that the manufacture and operation of vehicles too heavy for the existing roads be prohibited. As few of the roads were designed to carry motor-truck traffic, to have taken this course would have amounted to the throttling of a new development in transportation before it had a chance to demonstrate its utility, and it was rightly opposed with great energy by the manufacturers of motor vehicles. The latter, on the other hand, took a position at the opposite extreme from which they demanded the right to manufacture and sell heavy vehicles of large capacity, without regard to the strength of the roads, on the theory that the greater the capacity of the vehicle the smaller would be the cost of operation per unit of capacity. Their slogan was "build the roads to carry loads," and this was met by the opposite party with the equally dogmatic demand that the loads should be limited to the capacity of the existing roads.

The issue thus joined, the principals to the controversy, highway officials on the one side and the manufacturers on the other wisely agreed to submit their difference to the test of mutual discussion; and out of the series of conferences which ensued there came an agreement upon certain fundamental facts and principles which have served as the basis for a harmonious co-operation of the two groups, and which now constitute the foundations of highway improvement policy in all States.

Agree on Maximum Loads

It was agreed at the outset that for the first time in history the weight of vehicles had become a critical factor in rural highway design. Hitherto the minimum practical thickness of road metal had been sufficient to carry the maximum vehicular load. The development of the motor truck had altered this situation. It called for stronger surfaces that would spread its heavier load over a wider area of the sub-grade in order to reduce the intensity of the pressure to an amount which the soil would support.

It was clear also that whereas deterioration of the highways had previously resulted mainly from the attrition of the surface, a new form of deterioration approaching rapid destruction would result unless the roads upon which the heavier motor trucks were being operated were strengthened so as to enable them to carry the increased weights. And whereas, the amount of the deterioration had formerly been a function of the volume of the traffic and of time, the new destruction by excessive weight might be caused by a few vehicles in a very short time.

It was agreed, therefore, that the highway officials must have definite knowledge of the maximum weight to be supported as a first condition of design; and this knowledge was supplied, in a measure, by the voluntary decision of the manufacturers to limit to 7½ tons capacity the future production of vehicles. Engineers were thus assured that if, in the reconstruction of the thoroughfares upon which heavy trucking had developed, they would design to accommodate a vehicle of 7½ tons capacity they would not see their handiwork quickly destroyed by vehicles of much greater size and weight.

Reduce Total Cost of Transportation

But this alone was not a sufficient basis for the design of all roads. The building of roads of sufficient strength to carry 7½-ton trucks required a heavy investment of public funds, which could be justified only if the economies inherent in the transportation of goods in vehicles of large capacity were sufficient to outweigh the increased cost of the roads. It was recognized clearly for the first time that the cost of highway transportation is made up of the cost of the highways and the cost of operating the vehicles over the highways, and it was agreed that the common purpose of the public highway officials, vehicle manufacturers and operators should be to reduce the total cost of transportation rather than one or the other of the elemental costs. It could be proved that the number of large-capacity trucks already using some of the highways—principally those radiating from and connecting the larger cities—had already

grown to the point where the combined savings in operating cost would more than balance the greater cost of providing highway service for them. As to these highways there could be little doubt of the wisdom and economy of building a type of surface adequate for the heavy truck traffic. Other roads, similarly located with respect to cities, had not yet developed a sufficient amount of heavy traffic to repay the additional cost of the stronger construction, but it was not difficult to foresee that such a condition would develop in the future. On the majority of the roads, however, the development of traffic of sufficient weight to justify the higher types of construction was very remote; and it was apparent that the one-time prevailing condition of uniformity of traffic of all roads had been definitely broken down. Instead, a new and much different condition had arisen under which the main inter-city roads were found to be carrying traffic far in excess of the much greater mileage of local roads.

Under the new condition the economic justification for the improvement of the main roads lay to a far greater extent than formerly in the reduction of transportation costs and to a lesser degree in the effect upon the value of property. The main roads had become through traffic arteries, as distinguished from the more numerous local roads which continued to be of value primarily through the service they render in giving access to the land.

Main Road Traffic Increases

As to the main roads, which carried a wide-ranging traffic, it was now clearly apparent that the character of their improvement must be commensurate with the density of their traffic; that continuity of improvement was of the highest importance; and that the traffic was already so great that the loss in operation of vehicles in the absence of road improvement would exceed the cost of improvement. These roads also were distinguished in one other respect, namely, that their traffic tended to increase far more rapidly than that which was to be found on the local roads, the condition of which remained much as it had been. Where the main roads carried long-distance traffic, the local roads served the traffic of a neighborhood; where the main roads were collectors of traffic, the local roads were feeders and distributors; where the traffic of the main roads tended to grow in direct proportions to the growing use of motor vehicles and the growing resort of industry and the entire people to highway transportation, the local roads served the much lighter, and, from the standpoint of growth, far more stable traffic produced by a single agricultural community.

It became apparent, therefore, that the economic justification of local road improvement would continue to rest largely in the value and importance of the land that, in the main, the traffic would demand only a low type of improvement; and that continuity of the improvement was not so essential as in the case of the main, through roads.

National System Established

The need of continuity in the improvement of the main roads was the first of the new conditions to be met with appropriate action. From 1915 on, all States in rapid succession designated systems of State roads, including generally the main inter-city roads, to be improved under the more or less direct supervision of the State highway departments; and the several state systems were substantially welded into a national network by the designation, in 1921, of the Federal aid highway system which, though not quite co-extensive with the State systems, is practically coincident with them throughout its extent.

Continuity of improvement of the main roads thus assured it remained for a joint committee representing the American Association of State Highway Officials and the National Automobile Chamber of Commerce to enunciate a policy with respect to the rate and manner of the improvement which could win general support and adoption.

Briefly that policy may be stated as follows. It is accepted as a truism that the volume of traffic on the main roads is so great that the economies in transportation effected by road improvement clearly outweighs the cost of the improvement. This being true, the improvement should proceed as rapidly as available supplies of labor and material will permit and without other limit. All roads should be improved to the degree justified by the operating savings that may be expected to accrue to the traffic, and no road should be improved to any greater degree. Where the mileage of road to be improved is so great that the type of improvement indicated by the traffic cannot be completed on the whole mileage within a short period the most important sections should be raised immediately to ultimate type, and the balance of the mileage should be advanced through the initial stages of grading, draining and low type surfacing in order to spread as much of the benefit of improvement as quickly as possible over the entire road system, further improvement to await the completion of the first stage over the whole system. This is the practice known as stage-construction and it is the only feasible practice in the numerous States in which a large mileage of main roads remains to be improved in the face of a traffic already highly developed. It is also the logical plan of development for the main roads of the States in which traffic has not yet grown to the proportions justifying high-type surfacing.

Plan for Ultimate Growth

In any case the stage-construction plan takes account of the rapid growth of traffic, which is a characteristic especially of the main roads, by providing fully in the initial stage for the subsequent construction. Grades and alignment are designed to meet ultimate requirements; drainage structures are built of durable materials; rights-of-way of ample width for the future are obtained; and the initial surfacing becomes the sub-base of the second-stage surfacing. Obviously the soundness of the plan is contingent upon the complete and continuous maintenance of each stage of the construction, a kind of maintenance which—thanks to the war experience and the standard established by the Federal Highway Act—practically all States are now prepared to give.

The accepted policy contemplates the improvement of

the main roads, to which the above methods are applicable, as a responsibility of the States to be assumed through the agency of the State highway departments, and financed, in large measure, by the revenues derived from the taxation of vehicles and motor fuel. The local roads are viewed as the responsibility of the counties and lesser subdivisions. With a few important exceptions, as in the case of Cook County, Illinois, and the vicinity of other large cities, the degree of improvement required does not rise above the lower types of surfacing, the expense of which may be met, as it should be, by taxation of the local land and property.

These, then, are the outstanding developments in highway improvement of the post-war period: The classification of highways according to traffic density; the designation of State highway systems in all States, the systems including the heavy traffic highways of State-wide importance; the intersection of the State systems by means of the Federal aid system; the improvement of roads in accordance with traffic demands to the limit set by probable operating savings; the stage-construction plan of progressive improvement of entire systems; and the development of adequate maintenance provisions. In the main, all are outgrowths of the war experience fostered by Federal aid.

Research Develops New Science

One other great advance has characterized this period —the application of scientific research to the problem of developing types of construction and methods of administration and finance adequate to meet the demands of the fast-growing traffic. In this also the initial impulse came from the Federal Government and, in co-operation with State highway departments and universities, it is continuing to support numerous studies in several fields, as a result of which there is being built up gradually the structure of a new science—the science of highway engineering.

The investigations include studies of the characteristics of materials—sand, stone, gravel, bituminous materials, cement, concrete and brick; determination of the forces applied to road surfaces by standing and moving vehicles; of stresses developed in the structure of roads and bridges by live loads, and by temperature and other natural causes; analyses of subgrade soils and tests of methods designed for their improvement; studies of the flow of water through drainage structures, of the run-off from drainage areas, of the effect of moisture on soils, and many others of fundamental importance and value.

Popular interest has centered upon the large scale tests such as those of the Bates Road, for which entire credit is due the Illinois department, the Pittsburg (Calif.) experiments, the impact tests at Arlington, Va., and the intensive studies of highway traffic conducted by the Bureau of Public Roads in co-operation with the authorities of Connecticut, Maine, Pennsylvania, Ohio, California, Tennessee and Cook County, Illinois.

Building for the Future

Much that is of immediate practical benefit has already been derived from these investigations; but, for the most part, they are dedicated to the future.

It is not to be expected that their fullest benefits shall be immediately realized. The building of a science is a laborious, a painstaking process, and we are still but laying the groundwork which is not much further advanced than were the foundations of the modern science of medicine and surgery 50 years ago. If 50 years hence the science of highway engineering has been built up to the point now attained by the physicians and surgeons this effort we are now putting forth will be abundantly repaid, and not too late. For the improvement of highways in the United States is a process which must be continued indefinitely.

It is idle to talk of completion when of the three million miles of our highways less than a fourth have been graded, but a sixth has been surfaced and a sixtieth paved; when little more than half the mileage of the main State roads has been improved with any kind of surfacing, and there remain on these important arteries thousands of substantial one-way bridges and dangerous railroad grade crossings; when the number of motor vehicles registered is doubling every fifth year and the traffic with them; when the size of our cities and the magniture of our industries, and the amount of our material wealth are increasing at an almost unprecedented rate. So long as these conditions continue we shall continue to build and maintain and rebuild our roads.

At the present rate we are surfacing approximately 40,000 miles a year and our annual expenditure approximates a billion dollars. There is no indication of an early reduction in these rates of construction or expenditure, dwarfed as they are by the annual production of a 1,000-mile procession of motor vehicles and an annual expenditure for operation approaching ten billions. As a nation we have set our hands to the economic improvement of our means of highway transportation. It is not a task to be accomplished in a day. It is, and must be a continuous process. There is but one limit which may reasonably be set. It is this: No road should be improved by expenditures of public funds in excess of its earning capacity. The return to the public in the form of economic transportation is the sole measure and justification of the degree of highway improvement.

The CRUSHED STONE JOURNAL
J. R. BOYD, Editor
A. T. GOLDBECK, Director, Bureau of Engineering
The National Crushed Stone Association

OUR ANNUAL CONVENTIONS

There is no single event during the course of the year which is looked forward to with more real interest and pleasure by those engaged in the production of crushed stone than is the occasion of our annual conventions. More and more these annual meetings are assuming the aspect of an institution—and rightly so, for here gather, from all parts of the United States and Canada, men engaged in this basic industry in order that, through contact with others engaged in a similar line of endeavor and the resultant exchange of experiences, they may be better able to cope with the problems which will confront them during the coming year.

It is not mere idle talk when we say that hundreds of dollars, perhaps even thousands, have been saved as the result of ideas picked up at the annual conventions or of learning from a fellow producer of some costly mistake it was his misfortune to make and thus avoiding its possible duplication in your own instance.

The Manufacturers' Division Exhibition of Quarry Equipment and Machinery is in itself a veritable gold mine of information. There will be displayed at this Exhibition the very latest developments and improvements in the materials and appliances used throughout the industry, and although an inspection of this Exhibition will be of interest and value to everyone, this seems to us to be particularly true in the case of Superintendents and Operating Men.

The program which is being prepared for you is unusually comprehensive, touching practically every phase of the industry, and includes prominent Federal and State Officials, Highway Engineers, and Railway Executives. These men are making a considerable sacrifice of time and energy to be there and tell us about the many developments during the past year as well as about those which can be looked for in the future, a knowledge of which is vitally necessary for the healthy growth of the industry.

Aside from the many commercial benefits to be obtained from attendance at our annual meetings, the social side of these gatherings should by no means be overlooked.

It is a rare pleasure indeed to at least once a year be able to meet the fellows from other parts of the country, renew old acquaintances and make new ones. Competitor shakes hands with competitor and each marvels at the admirable traits of the other which heretofore had been entirely unsuspected. In short, these annual meetings serve to break down all barriers and prejudices and cement us together in one common cause—the advancement of the crushed stone industry.

It is practically impossible for one to attend a National Crushed Stone Association convention without returning home imbued with a fuller realization of the importance of the industry in which he is engaged and a consequent increase in his own self respect.

Of the Annual Banquet and Smoker, little need be said but to mention them, as their fame has spread far and wide and our Annual Convention could not be considered complete without them.

You can make no better investment than to attend the Tenth Annual Convention of the National Crushed Stone Association which will be held at the Book-Cadillac Hotel, Detroit, on January 17, 18, 19 and 20, 1927.

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NATIONAL OFFICERS ON EXTENDED TRIP

In view of the fact that National Officers, President Graves, Secretary Boyd and Mr. Goldbeck, Director of the Bureau of Engineering, are at present engaged in taking an extensive trip through the western, southwestern, and southeastern states, details of which were given in the October Journal, it has been necessary to omit in this issue of the Journal certain sections which it has heretofore been our custom to carry. We ask your indulgence in this matter and wish to assure you that the omission is only temporary and that the omitted sections will be carried as usual in the December issue.

MANUFACTURERS' DIVISION EXHIBITION
of
QUARRY EQUIPMENT AND MACHINERY

displaying the latest developments and improvements in materials and appliances used in the crushed stone industry

Crystal Ballroom, Book-Cadillac Hotel, Detroit
One of the two adjoining rooms in which the Manufacturers' Division Exhibition will be held

Visit the Exhibition and get first hand information about the equipment or material in which you are particularly interested.

One hour spent with the Exhibitors is infinitely more profitable than studying catalogues and engaging in lengthy correspondence.

Tenth Annual Convention
National Crushed Stone Association
Book-Cadillac Hotel, Detroit, January 17, 18, 19 and 20, 1927